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IN THE

Supreme Court of the United States

October Term, 1975
No. 74-1033

C. MARSHALL DANN, COMMISSIONER OF PATENTS & TRADEMARKS,

Petitioner,

vs.

THOMAS R. JOHNSTON,

Respondent.

On Writ of Certiorari to the United States Court of Customs and Patent Appeals.

BRIEF AMICUS CURIAE FOR CALIFORNIA PATENT LAW ASSOCIATION.

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BRIEF AMICUS CURIAE FOR CALIFORNIA PATENT LAW ASSOCIATION.

I.
The Question.

Whether claims in the form authorized by 35 USC 112, to a machine embodying an invention meeting the statutory conditions for patentability of 35 USC 102 and 103, are unpatentable under 35 USC 101, solely because the claimed invention can be embodied in a general purpose computer modified by programming it to function in a specified manner.

II.

Interest of the Amicus.

The California Patent Law Association is an organization of lawyers representing inventors in California. Its members have no special interest in the outcome of this case as far as the particular invention is concerned, but are concerned about the impact of this case on the development of the law. Our members are patent attorneys, both corporate and private; trial lawyers who act one day for a patent owner and the next day against the patent owner; as well as practitioners of all other aspects of the specialty of patent law. Again, in the year 1974, California leads the nation in the number of patents granted to its inventors. The great majority of these patents were prepared by members of our association. The largest state having the largest number of patents granted to its inventors, is also the home of the largest state-wide organization of patent lawyers. Our interest in this case is simply just and proper protection for inventions, no more and no less.

We approach this matter on the side of the respondent because we believe patent protection should be granted to any invention which satisfies the statutory criteria for patentable subject matter.

The California Patent Law Association is interested in even-handed administration of the patent law without regard to the technology out of which an invention arises. An invention is not excluded from the classes of inventions recited in 35 USC 101 merely because it relates to a computer or a computer program.

III.

Consent.

The California Patent Law Association has received consent from both parties to file this brief amicus curiae. The letters of consent have been filed with the Clerk of the Court.

IV.

Summary of Argument.

It is important that the question of what constitutes *statutory* subject matter under 35 USC 101 be distinguished from the question of what constitutes *patentable* subject matter under 35 USC 102 and 103. Even a claim that is not patentable may still define statutory subject matter.

The issue presented by this case that concerns amicus curiae is whether the claims presented in the application define a machine within the statutory meaning of 35 USC 101. Although Petitioner appears to contend that machines which are related to computers or computer programs should be treated differently from all other machines, the claims clearly define a machine.

A means-plus-function claim, expressly recognized as proper under 35 USC 112, does not cover a mental process or an idea as such, but only the implementation of the function by a mechanism or device, that is a machine.

Programming of calculators is a long-known technology. Calculators have been programmed mechanically to perform the addition, subtraction, multiplication,

and division algorithms of arithmetic for hundreds of years. The art of programming the operation of other machines by various temporarily installed mechanical means, such as punched tapes and decks of punched cards, is more than 300 years old. The programming of general purpose digital computers by the use of stored programs, such as replaceable punched tapes and punched cards, was first conceived about 140 years ago and first put into practical use before 1944. Such programming is excitingly different and more advanced than programming with only gears, levers, cams, etc., and opens up vast areas of invention.

When a program device, such as a deck of program cards, is combined with a modern general purpose digital computer, the computer is transformed into a machine that is different from the original general purpose computer. In this process, the states of memory elements, such as magnetic cores, electromechanical relays, or the voltages on electronic elements in the old computer, are transformed, creating a new interdependence between those elements and the rest of the computer and external devices. Unlike a player piano that merely translates holes in a paper roll into sounds on a one-for-one basis,* such a newly programmed general purpose digital computer is a new machine and has new properties and is capable of performing new functions when later supplied with signals that represent data to be processed.

**White-Smith v. Apollo*, 209 U.S. 1 (1907).

Every invention, before it may be patented, must be novel and unobvious, in view of everything which has been done beforehand, that is, in view of all of the prior art. For new and improved machines, whether they be digital computers or the special purpose electronic computers which are created, or manufactured, when new programs are incorporated in them, each machine must be judged against the prior art. That art includes prior computers, prior computer programs, and prior programmed computers. Each new machine warrants patenting, if it passes muster on the criteria established by Congress in Title 35 of the U.S. Code.

This court in *Gottschalk v. Benson*, 409 U.S. 63 (1972), correctly held that the subject matter there presented was not properly claimed. That holding should not be expanded here to state that a programmed computer does not constitute statutory subject matter under 35 USC 101 and that it is not capable of being patented even if the other requirements of the patent statute are met.

The main focus of this case should be on whether a new machine is created by programming a computer in order to provide the structure to perform specified functions. Computer-related machines should not be classified as non-statutory subject matter unless Congress so requires. The present law includes no such artificial classification.

V.

The Claimed "Machine System" Is a Machine Under 35 U.S.C. 101.

The claims presented in this case are detailed recitations of parts and means for performing specified functions. Claims may incorporate elements ". . . expressed as a means . . . for performing a specified function with the recital of structure . . ." 35 USC 112. As such, they should be considered to be the proper subject matter for a patent, in the field of computer technology just as they are in other fields, and the determination should then be made as to whether the claims meet the conditions for patentability.

Petitioner, however, asks this court to stop at the threshold question of whether the "machine system" is a machine. It is Petitioner's contention that the subject matter of the claims is not a machine at all, but an abstract intellectual concept not represented in a concrete form (Brief p. 21). The Petitioner refuses to recognize that apparatus claims written in means-plus-function form cover only the physical machine disclosed in a patent application and equivalents thereof. The principle that abstract ideas are not patentable is sound and well-established in the cases reviewed in *Gottschalk v. Benson*. But the principle has no application to this case.

Benson questioned whether the invention there presented was properly claimed as "a 'process' within the meaning of the Patent Act", 409 U.S. 63 (1972), and found that it was not properly claimed because the claims were too abstract under the guidelines of Supreme Court cases of the last century.

The invention presented here is concrete and not abstract. Unlike *Benson*, the apparatus claimed here is not broad enough to cover a "scientific truth or mathematical expression of it". *Mackay Radio & Telegraph Company, Inc. v. Radio Corporation of America*, 306 U.S. 86, 94 (1939). Computer programs and computers may, if properly defined, be concrete and not simply mathematical formulae. They should be no more and no less patentable than any other inventions. There should be no special rules for programmed computers or programming of computers as opposed to other categories of inventions, just as there are no rules special to catalysts, enzymes, and the like.

The government criticizes the court below for elevating form above substance in limiting *Benson* to processes and distinguishing the present apparatus claims. Yet the government itself places form above substance in characterizing the invention here presented as an "idea", rather than an invention. An idea may be an invention and it may be patentable if it is concretely defined within the guidelines laid down by Congress in 35 USC 112. If the idea is not expressed in concrete terms, that is as an apparatus, process or the like, then it fails to meet 35 USC 101 or 35 USC 112. But here the invention is concretely defined as a machine. Whether or not the invention is patentable is a separate question. In any event, the invention is not merely an abstract idea.

The characterization of the invention as an idea tends to place programmed computers in a class by themselves, which is not Congress's stated intent. The patent laws that have been enacted by Congress require the evenhanded application of all applicable statu-

tory provisions to the claims of the application presented here.

One of the enduring values of the patent system is that it has remained relatively unchanged since 1836. The Act of 1836 granted a patent "to anyone who may have discovered or invented any new and useful art, machine, manufacture or composition of matter." 5 Stat. 117, Sec. 6. This language is nearly identical to our present Section 101, except that today "process" is a more popular synonym than "art".

In *Burr v. Duryee*, 68 U.S. 531 (1863) the patent, to one Wells, was first issued with detailed claims about a hat-making machine illustrated at 68 U.S. 543. The claims are quoted at 68 U.S. 567. The Supreme Court noted that "the original patent of Wells has been more than once decided by the courts to be a valid patent . . . He claims all he had a right to claim as new and no more" (68 U.S. 571). In short, the Wells patent met all of the criteria of the patent laws, including novelty and unobviousness.

The problem in the *Burr* case is that the original patent was reissued as separate patents for the machine and the process in 1856 and was again reissued in 1860, the second time claiming an invention as ". . . forming bats of fur fibres by throwing the fur in properly regulated quantities, substantially as herein described". (68 U.S. 568). The Supreme Court stated that this was an "expansion by an equivocal claim which may be construed a claim for the result or product of the machine, or for its principle or mode of operation". It was an "ingenious attempt by the assignee to expand it into an abstraction". (68 U.S. 568.)

This is the kind of problem that was involved in the old cases referring to "ideas" and "abstractions". Today we would say the claims are either non-statutory under Section 101 or indefinite under Section 112. Even though a specific machine is disclosed, the claims in *Burr* were by the time of the second reissue so indefinite as to constitute abstractions. But *Burr* also pointed out that a machine is not an idea as in a machine.

In contrast, the claims of the Johnston application describe the machine in almost infinite detail. It is inconceivable that claim 20 (Appendix, page 107) could be deemed a mere abstract idea. This claim shows that Respondent is not seeking a patent ". . . for a 'principle' or a 'mode of operation', or an *idea*, or any other abstraction", *Burr v. Duryee, supra*, but only a patent on a machine.

All inventions are based upon ideas. So far as 35 USC 101 is concerned, the sole question is whether the claims cover the idea *per se* or whether they are limited to the implementation of the idea.

The proper inquiry on patentability is whether the machine is new and non-obvious, not whether it is abstract or concrete. As the Court noted in *Benson*, "transformation and reduction of an article "to a different state or thing" is the clue to patentability of a process claim that does not include particular machines". It follows that the patent law is not frozen in old technologies, and that patents for machines involving programmed computers are not to be foreclosed.

Computer-related inventions have been patented for years and should not now be treated as *sui generis* in the absence of Congressional action.

Even though an *idea per se* does not constitute statutory subject matter, inventions that are concrete expressions of ideas may be claimed as processes, machines, compositions of matter, or articles of manufacture, as the case may be. 35 USC 101.

So far as computer technology is concerned, inventions are often embodied in the programmed computer itself. The programmed computer may be claimed as a machine or apparatus. Machine claims that are based on a transformed computer are clearly within the ambit of the patent law, even if a program *per se* is not.

In *O'Reilly v. Morse,* 56 U.S. (15 HOW) 62 (1853) this court said:

> "While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful *structure* created with the aid of knowledge of scientific truth may be." (Emphasis added).

A newly programmed general purpose computer which is unobvious, definitely claimed, and meets all other statutory tests, is just such a new and useful structure.

While it is true that in *O'Reilly v. Morse,* claim 8 was held to be invalid because it was too broad, other claims were held to be valid. Claim 5 is particularly important from the standpoint of the present case because there the invention was defined in terms of the meaning of a code.

Robinson, in his *Treatise on the Law of Patents,* (1890) Vol. 1, page 259, defined "machine" as:

> ". . . an instrument composed of one or more mechanical powers and capable when set in motion of producing by its own operation certain predetermined physical effects."

It follows that since a programmed computer operates in a new way, it constitutes a new machine.

The Patent Office has long recognized that the relations between parts of a patentable claim may be expressed by means of mathematical formulas, *Ex parte Avery,* 41 USPQ 238 (Pat. Off. Board of Appeals, 1939); *Ex parte Massa,* 48 USPQ 331, 333 (Pat. Off. Board of Appeals, 1940). So also has this Court. (*Mackay Radio & Telegraph Company, Inc. v. Radio Corporation of America, supra*).

As early as 1942, the Patent Office issued a patent on an IBM card *per se* in which two additional rows of holes and non-holes were added. The Board held that the new arrangement of holes and non-holes constituted statutory subject matter, *Ex parte Lang,* 56 USPQ 423 (Pat. Off. Board of Appeals, 1942). These claims include limitations regarding how the holes in these two rows were related to holes elsewhere on the card in order to provide an interpretation of the latter holes. In effect, the relationship involved an unpatentable algorithm for ascertaining the meaning of the holes and the patent issued for the article (card), not for the algorithm *per se.*

In the last century, there was debate about the kinds of "process" that were contemplated in the Constitution by the term "useful art". *Corning v. Burton,* 56 U.S. (15 HOW) 252 (1853) concluded that processes ". . . where the result or effect is produced by chemical action, by the operation or application of some element or power of nature, or of one substance to another" are within the scope of the patent laws, notwithstanding the failure of the Patent Act of 1836 to make a process, *eo nomine,* the subject matter of a patent. This

definition of process was expanded to include ". . . an act, or a series of acts, performed upon the subject matter to be transformed or reduced to a different state or thing." in *Cochran v. Deener*, 94 U.S. 780 (1876). By 1880, this court could state without hesitation: "That a patent can be granted for a process, there can be no doubt." *Tilghman v. Proctor*, 102 U.S. 707 (1880).

One would have thought the matter settled nearly a century ago, but Petitioner and the CBEMA seek to set aside the field of computers and computer programs as *sui generis* and not subject to the normal rules of the patent laws enacted by Congress. Whether it is claimed as a process, as in *Benson*, or as apparatus, as here, the invention should be measured for its intrinsic worth under the statutory guidelines as interpreted by this court, notably in *Graham v. John Deere*, 383 U.S. 1 (1966).

The Petitioner and Computer and Business Equipment Manufacturers Association both rely heavily upon the analogy of computer programs on a piano roll. We believe that this analogy is inapposite.

In its application to the facts of this case, *White-Smith v. Apollo, supra* is no different than *O'Reilly v. Morse, supra, Burr v. Duryee, supra*, or any of the other cases dealing with the dichotomy of abstract idea versus concrete expression. *White-Smith* held that a piano roll is not a copy of a copyrighted sheet of music in the sense of the copyright statute. This Court said that a statutory copyright does not extend to every means of expression of the order of notes in a melody. 209 U.S. at 11. A copy of a musical composition must be ". . . a written or printed record of it in intelligible

notation" (209 U.S. at 17). The argument was rejected that copyright is intended to protect the melody itself and all means of expression of the order of notes which the composer has invented (209 U.S. at 11). Stated another way, the form of expression as sheet music is protected by copyright, but another form of expression of the abstract idea (piano roll) is outside the scope of the copyright, even though the abstract idea in the melody is the same.

This philosophy is well grounded in copyright law, and has been recently expressed in *Goldstein v. California*, 412 U.S. 546 (1973). There a different means of expression of the same abstract idea (tape) was held to be outside the scope of the copyright statute so that the states were free to regulate trade in that form of expression, even though the abstract idea recorded on the tape was the same. Tape reproduction was held to be potentially a "writing", but Congress had not yet acted when the facts of the case arose.

But this case differs from *White-Smith* and *Goldstein* because Congress has already stated the criteria for patentability in Title 35. This case is not a question of new technology having outpaced the scope of the patent laws, as the *Goldstein* case involved technology that outpaced the copyright law. Here it is simply a question of whether the machine claimed is within the statutory classes defined in 35 USC 101 and meets the tests of 35 USC 102, 103 and 112.

In *White-Smith* this Court pointed out that a piano roll is a mechanical device. From this it follows that a punched tape or the like may form the basis of a patentable combination.

The admonition of *White-Smith* that "The statute has not provided for the protection of the intellectual

conception apart from the thing produced, however meritorious such conception may be . . ." (209 U.S. at 17) does not apply in this case because the claims relate to "the thing produced", not merely the conception.

The machine of the present application is still a machine, even though it is computer related. It is not a mere idea simply because a computer may be involved.

VI.

Programming a Computer Changes It to a New Machine.

When a program is fed to a programmable computer, the states of various elements in the computer are transformed. If the program is new, then the pattern of states of the various elements is new. The computer with its elements transformed to those new states is a new computer with its parts interrelated in a way that never existed before. Of course, it is another question whether the new computer is worthy of a patent. Nevertheless, it is a new machine.

The states of the various parts of a computer that has been programmed are far less elusive than the states of the elements or groups of elements in a new chemical compound. That pattern determines the functions of the computer.

Programming of machines has been accomplished with the aid of numerous programming devices, such as levers, dials, cams, punched tapes, and punch cards since long prior to the year 1800.

Though algorithmic computers have been manufactured in increasing numbers since the Sixteenth Century, one was made at least as early as about 1000 A.D., and replaceable punched-card programs have been widely understood since at least as early as 1834 (See Appendix A attached hereto).

Programs have long been stored in metal parts by cutting them to desired shapes, in tapes or cards by punching them with coded patterns of holes, and in the memory elements of a general purpose digital computer by changing their states. Just because technology has now grown up to the point where levers and cams have given way to punched cards and memory elements as parts of machines, is no reason to change the patent laws and to penalize inventors who make use of modern technology instead of just the old technology.

A programmable computer is not wholly dissimilar to other kinds of inventions. For example, certain reagents, such as catalysts, may be known and old in themselves, yet in combination with other material produce surprising "non-obvious" results. A catalyst is, by definition, the same at the end of a chemical process as it was at the start. Yet it is capable of greatly simplifying the burden of arriving at the production of a desired product. Economic and technical advantages are part of the measuring stick to determine whether a patent should be granted. A catalyst may be used in a new reaction, even if the catalyst is old, and still the reaction will be (possibily) worthy of patent protection.

The effect of the new structure created by programming the computer is far different from merely feeding a new series of numbers to an old calculator, such as an abacus or Pascal's adding machine, to process the new numbers fed into it in the same old way.

The language of 35 USC 101 fits a programmed computer perfectly, if it is new and useful. The statute says that a person is not only entitled to a patent on a machine, but also to an improvement of it thereto. A programmed computer accomplishes more than an unpro-

grammed computer and is therefore certainly "an improvement of an unprogrammed computer", and hence is at least an improved machine.

Though algorithms per se do not constitute statutory subject matter under 35 USC 101, all processes and machines that are implemented with the aid of algorithms, should be recognized as constituting statutory subject matter.

When a program acts upon a programmable computer to change it to a new machine which performs new functions, this constitutes statutory subject matter under 35 USC 101 and is patentable if the invention meets the requirements of 35 USC 102 and 103, and the claims conform to 35 USC 112.

In his reply brief on the Petition for Writ of Certiorari, the Petitioner has admitted at page 2, the *possibility* of *patentability*

1. If a program coacts with an ordinary computer in a synergistic way, OR
2. If the program is carried out with newly invented apparatus, OR
3. If a program produces a new use for an old machine sufficiently inventive to be patentable as a process.

Possibility of patentability necessarily implies that the subject matters in all three categories are statutory under 35 USC 101, even if they are not patentable under 35 USC 102 and 103.

Johnston's claims define a new machine in accordance with the provisions of 35 USC 112, unlike those of *Benson*. These claims define subject that matter falls both in categories 1 and 2 above, which the Petitioner

admits constitutes potentially patentable subject matter and hence even if not patentable, constitute statutory subject matter.

It makes no difference whether the machine that is programmed is a loom, a radio receiver, a printing press, an automobile factory, a power plant, a set of traffic lights at an intersection of two boulevards, or a computer. And it makes no difference whether the programming is done with gears, cams, or punched cards, or whether electrical or magnetic or some other natural force is used. Congress has not excluded any of those kinds of devices or programming systems from the field of statutory subject matter.

Congress has declined to contract the patent laws to exclude programmed computers from statutory subject matter in the face of the recommendations of the President's Commission (Report of the President's Commission on the Patent System, November 17, 1966).

The Commission had recommended that

> "The classes of patentable subject matter *shall continue as at present, except:*
>
> . . .
>
> "3. A series of instructions which control or condition the operation of a data processing machine, generally referred to as a 'program', shall not be considered patentable regardless of whether the program is claimed as: (1) an article, (b) a process described in terms of the operations performed by a machine pursuant to a program, or (c) one or more machine configurations established by a program." (Emphasis added).

This recommendation, if enacted, was intended by its sponsors, to *change* the law so as to *exclude* from the field of statutory subject matter, inventions of the kind defined by the Johnston claims. Congress has persistently ignored that recommendation. Though Congress has considered many patent "reform" bills since that time, *none* of them has even included any provision for excluding computer programs from the field of statutory subject matter.

The Constitution places no restriction on what inventions are patentable. Congress has defined the classes of inventions that may be patentable in very broad terms and has not excluded programming of computers and programmed computers as patentable subject matter, and said inventions are patentable so long as the claims meet the requirements of 35 USC 102, 103, and 112.

The Petitioner should not be permitted to change the law indirectly by repeated petitions to this Court in a way that the President's Commission has failed to bring about directly by its appeal to Congress. Legislation to give special treatment to any segment of industry, such as manufacturers of general purpose digital computers and to deprive other segments, such as manufacturers of software, of patent rewards for their creations, should not be judicially mandated. If there is to be such special interest legislation, it should be left to Congress.

VII.

Conclusion.

For the above reasons, Amicus urges this Court to clarify *Gottschalk v. Benson* and particularly to hold that a newly programmed general purpose digital computer may be a new machine that constitutes statutory subject matter under 35 USC 101.

Respectfully submitted,

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APPENDIX A.

History of Algorithms, Digital Computers, and Programs.

This short history has been gleaned primarily from the works cited in the attached bibliography.

Our discussion is limited to digital computers, that is, to computers in which numbers are changed by discrete amounts, such as 1, or 2, or 3, etc. or multiples thereof. Almost all mechanical digital computers, e.g., adding machines, operate on the decimal digital system. Almost all electronic digital computers operate on the basis of the binary system. Both kinds commonly carry out calculations or other operations automatically in accordance with algorithms[1] that have been programmed into them. The programming may be incorporated in arrangements of gears, cams, punched tapes, punched cards, magnetic tapes, plugs and sockets, or wiring and solder joints. The day will come when the programming will be performed directly by action of the human voice on the computer.

Algorithms for performing operations of addition, subtraction, multiplication, and division have their origin in prehistoric times. It was in the Tigris-Euphrates valley, before about 3000 B.C., that a simple device was developed to facilitate carrying out algorithms manually. It was called the abacus. This device is still in common use in the Orient and in Eastern Europe. The abacus has long employed extra beads to enable the user to apply the 5-carry algorithm and the 10-carry

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[1]The term algorithm usually refers to a series of mathematical steps for solving a problem of a particular type. It also sometimes refers to a series of steps employed to carry out other processes. More modernly though, the term algorithm has also come to mean a computer program. The term algorithm is used in this appendix only in the first sense.

algorithm. Algorithms for solving complex problems in arithmetic were employed in Babylon in ancient times, but so far as we know, without any machinery (Knuth).

The idea for mechanizing the algorithms of the abacus occurred to the Moors before the year 1000. Early attempts at mechanization of computation were made by Gerbert of Autillac (later Pope Sylvester II from 999 to 1003), and Magnus. (Rosenberg, pages 20-21) Even Leonardo da Vinci had a hand in the subject in the 15th Century. (Rosenberg, page 21) And then:

> "The 16th Century . . . marks the decline of the abacus in Europe in favor of algorithmic methods of calculation." (Hawkes, page 9.)

Many calculators soon appeared for carrying out the algorithms of adding, subtracting, multiplying, and dividing mechanically (Schickard, 1632; Pascal, 1645; Morland, 1666; Leibnitz, 1694, and others). The first calculator that was programmed to enable its user to crank out a series of answers was that of Poleni (1709). Halacy calls Poleni's efforts the first attempt at programming a computer [Halacy, page 44].

Punched tapes and punched cards have been used to program the operations of a loom since before 1730 [Halacy, page 88 and Rosenberg, page 107.] Jacquard automated such looms in about 1804.

In the 19th Century, Charles Babbage, a banker's son and mathematician, designed two "general purpose" digital computers. They were general in different degrees. One was called the "difference engine", the other was called the "analytical engine". Several different persons constructed Difference Engines and put them into practical use (Babbage, Scheutz, Grant,

Deacon). Figure 1 illustrates some of the features of the Difference Engine and one of its "printouts" [from Eames, page 29].

With respect to Babbage's Difference Engine, Lardner wrote, in 1834, in patent-judicial language, after discussing prior work of others:

> "Even had the mechanism of these [earlier] machines performed all which their inventors [Pascal et al.] expected from them, they would have been still all together inapplicable for the purpose to which it is proposed that the calculating machinery of Mr. Babbage shall be applied. They were all constructed with a view to perform *particular arithmetical operations*, and in all of them the accuracy of the result depended more or less upon manipulation. The principle of the calculating machinery of Mr. Babbage is *perfectly general*[2] in its nature, not depending on any particular arithmetical operation, and is equally applicable to numerical tables of every kind." (Emphasis and bracketed portions added.) [Morrison, page 219.]

In 1833 Babbage conceived and commenced the design of his Analytical Engine. His plan for the Analytical Engine is shown in Figure 2 with a few legends added. The drawing is dated August 6, 1840 [Morrison, pp. 378-379].

The Analytical Engine was to be employed for solving almost any kind of algebraic equation and was even designed to solve simultaneous equations, depending upon how it was programmed. Each program was to be

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[2]Babbage's "Analytical Engine", conceived later, was even more general. What is general today may be considered special tomorrow.

embodied in a pair of decks of punched cards (see upper part of Figure 2) and was to operate on a set of numbers represented by a set of cards that we now call a data deck (see lower right of Figure 2). (Punched cards devised by Babbage are shown by Eames at page 12, and Hawkes at page 23.)

A program for solving a particular algebraic problem $x = (ab + c)d$ is represented in Figure 3.[3] This program was published by Babbage's son in 1888 [Morrison, p. 334]. As used in Figure 3 the term "column" refers to a stack of rotating gears and number wheels in which data is stored. The term column does not refer to a column on a piece of paper. In Figure 3, the first two sections identify the cards in the deck that were to form part of the machine for solving the problem. The third section describes the functions or operations performed by coaction of the cards with the rest of the machine. This same program could be used to solve the equations $E = MC^2$ and $A = \pi R^2$.

Each algorithm was to be embodied in a different pair of program decks. And each pair of decks could be removed and replaced by another. A library of program decks could be built up. Similarly for the data decks.

Babbage's Analytical Engine included three principal parts, a store (memory unit) and a mill (an arithmetic-algorithm performing unit) and a control unit, including the program cards and other components for controlling the interaction of the store, the mill, and peripheral devices, such as a printing press.

[3]The term "program" is often employed to refer to the list of instructions, such as those set forth in Fig. 3. Sometimes the term refers to a deck of punched cards or a punched tape or the like, or other device which coacts with the computer to cause the computer to carry out a series of steps to perform a predetermined calculation that may be desired or, more modernly, to send signals to various kinds of equipment, such as a printing press or a drill press, or a space vehicle, to cause them to act in some required manner.

The "mill" of a general purpose digital computer includes standard components arranged to perform certain simple functions, such as adding, subtracting, multiplying, and dividing.

The "store" receives, or holds, data signals. Today it also usually holds the program.

The nature and function of the control unit is determined by the program that has been stored in it. It controls the feeding of raw data (analogous to grains of wheat, etc.) to the mill, the exact nature and sequencing of the processing that occurs in the mill, and the allocation of the output of the mill to various parts of the output store or elsewhere.

The Analytical Engine designed by Charles Babbage became a reality in the period 1937 to 1944 under the leadership of Howard H. Aiken at Harvard University with the support of IBM and the Office of Naval Research. MARK I, also known as the IBM Automatic Sequence Controlled Calculator, embodied the principles of the general purpose digital computer described by Charles Babbage but employed electromagnetic relays and other electrical circuitry in place of many of the mechanical elements.

Figure 4 shows part of the MARK I including one of the punched tapes in which a program was stored (Aiken, Plate VI opposite page 14). Though this 2000 pound computer was the only one of its kind, it was so well known that it was necessary to publish a 561-page volume to describe its operations and the method of programming [Aiken, Preface].

As indicated in Figures 2 and 4, punched cards and punched tapes are devices in which programs are stored. In more modern computers, the programs are stored in memory units which include memory elements that have states that have been transformed by programming.

More modernly the programs are frequently first stored on a punched tape or a deck of punched cards or on a magnetic tape and then through a translation process that normally includes "compilation" and "assembly," the program is translated into a pattern of states which is stored in the memory elements of a memory unit that forms part of the computer. But just as a deck of punched cards or punched tape forms part of a computer, so also now the programmed memory unit with its changed states forms part of the computer.

Though Babbage's calculator has been likened to a flour mill (see Fig. 5 from Murphy, Vol. 1, page 77), it is really far more because it has many millstones and other devices which are controlled by a program deck to perform operations on input in new sequences to produce new kinds of results.

BIBLIOGRAPHY

AIKEN, Howard, H., et al., "A Manual of Operation for the Automatic Sequence Controlled Calculator", Harvard Univ. Press, 1946, in *The Annals of the Computation Laboratory of Harvard University*, Vol. 1.

EAMES, Charles & Ray, *A Computer Perspective*, (Harvard University Press, 1973).

HALACY, Dan, *Charles Babbage, Father of the Computer* (Crowell-Collier, 1970).

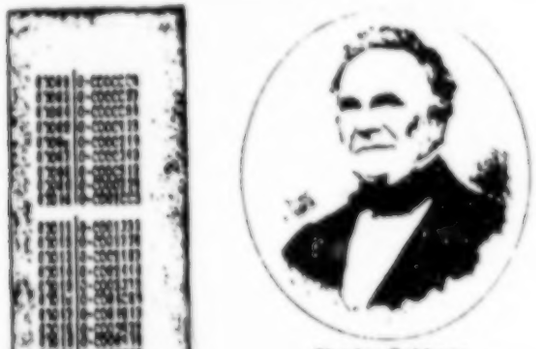
HAWKES, Nigel, *The Computer Revolution* (Dutton, 1972).

KNUTH, Donald E., *Ancient Babylonian Algorithms*, (*Communications of the ACM*, Vol. 15, No. 7, pp. 671-677) (July, 1972).

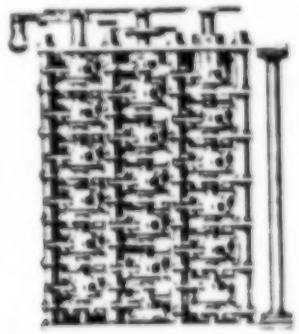
MORRISON, Philip and Emily, *Charles Babbage and his Calculating Engines* (Dover, 1961).

MURPHY, John S., *Basics of Digital Computers* (John F. Rider Publisher, Inc., 1958).

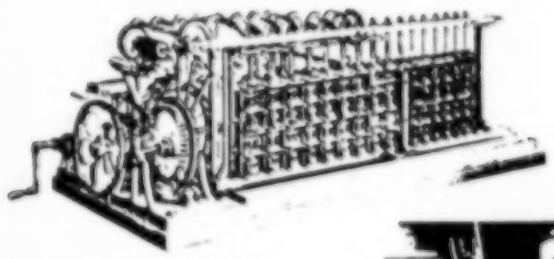
ROSENBERG, Jerry M., *The Computer Prophets* (Macmillan, 1969).



Charles Babbage



Babbage's difference engine



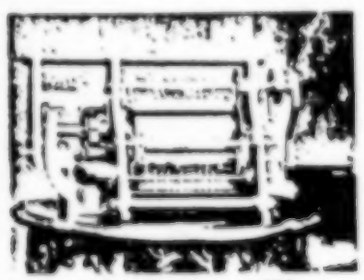
Difference engine built by
George and Edward Scheutz, 1853



George Scheutz



Type mold made by
the Scheutz engine



Wiberg difference engine, 1859

Difference Engines

These machines, which accumulated differences to produce tables for navigation, insurance, and astronomy, began with Charles Babbage's design in 1823. Other machines based on his concept followed. Perhaps five had been built by the turn of the century.

FIGURE 1.

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III

GENERAL PLAN OF ENGINE No. 1

Plan 25, dated August 6, 1840

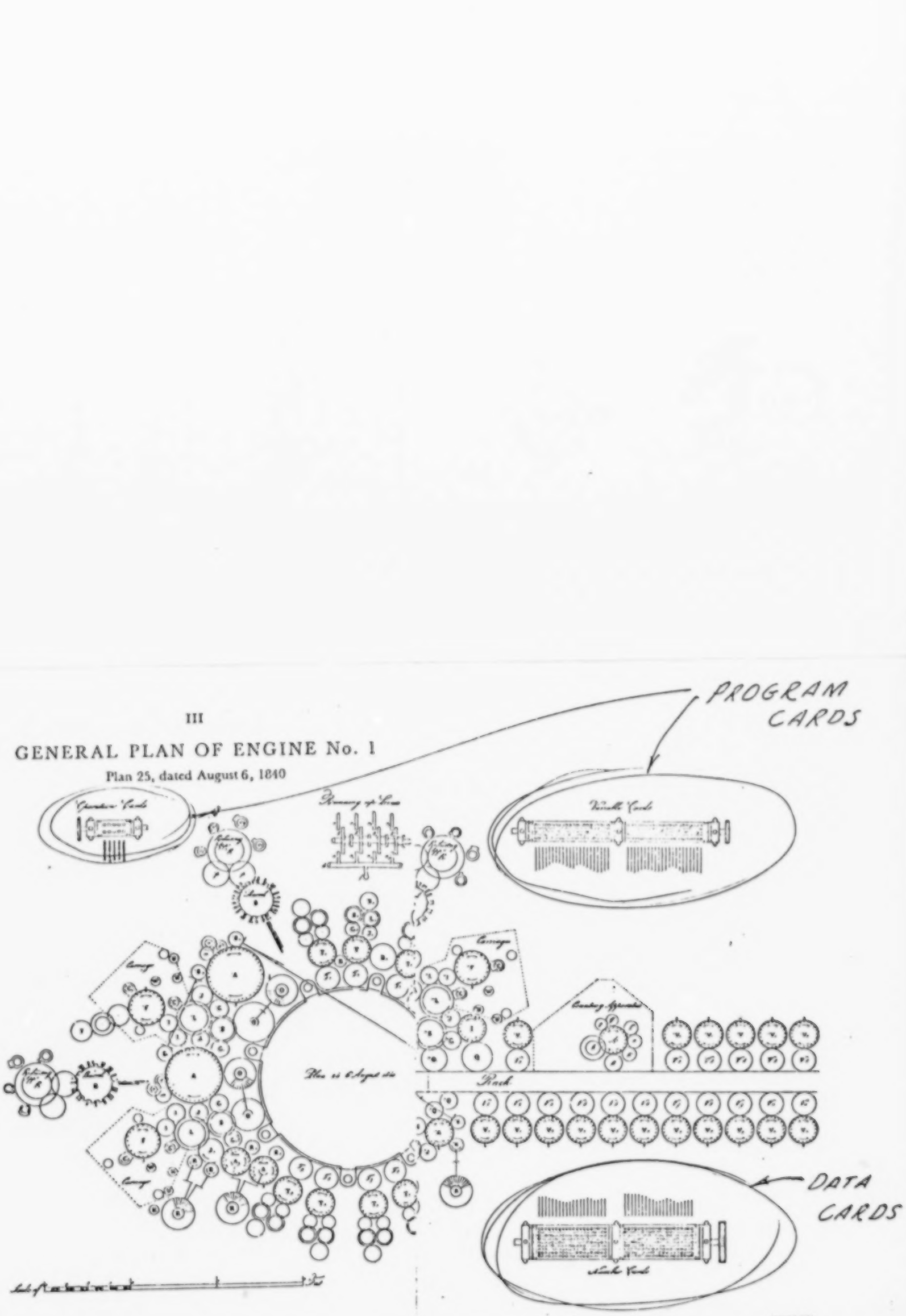


FIGURE 2.

Directive Card	Operation Card	—
1st	...	Places a on column 1 of Store
2nd	...	,, b ,, 2 ,,
3rd	...	,, c ,, 3 ,,
4th	...	,, d ,, 4 ,,
5th	...	Brings a from Store to Mill
6th	...	,, b ,, ,,
...	1	Multiplies a and $b = p$
7th	...	Takes p to column 5 of Store where it is kept for use and record
8th	...	Brings p into Mill
9th	...	Brings c into Mill
...	2	Adds p and $c = q$
10th	...	Takes q to column 6 of Store
11th	...	Brings d into Mill
12th	...	,, q ,,
...	3	Multiplies $d \times q = p_2$
13th	...	Takes p_2 to column 7 of Store
14th	...	Takes p_2 to printing or stereo-moulding apparatus

FIGURE 3.

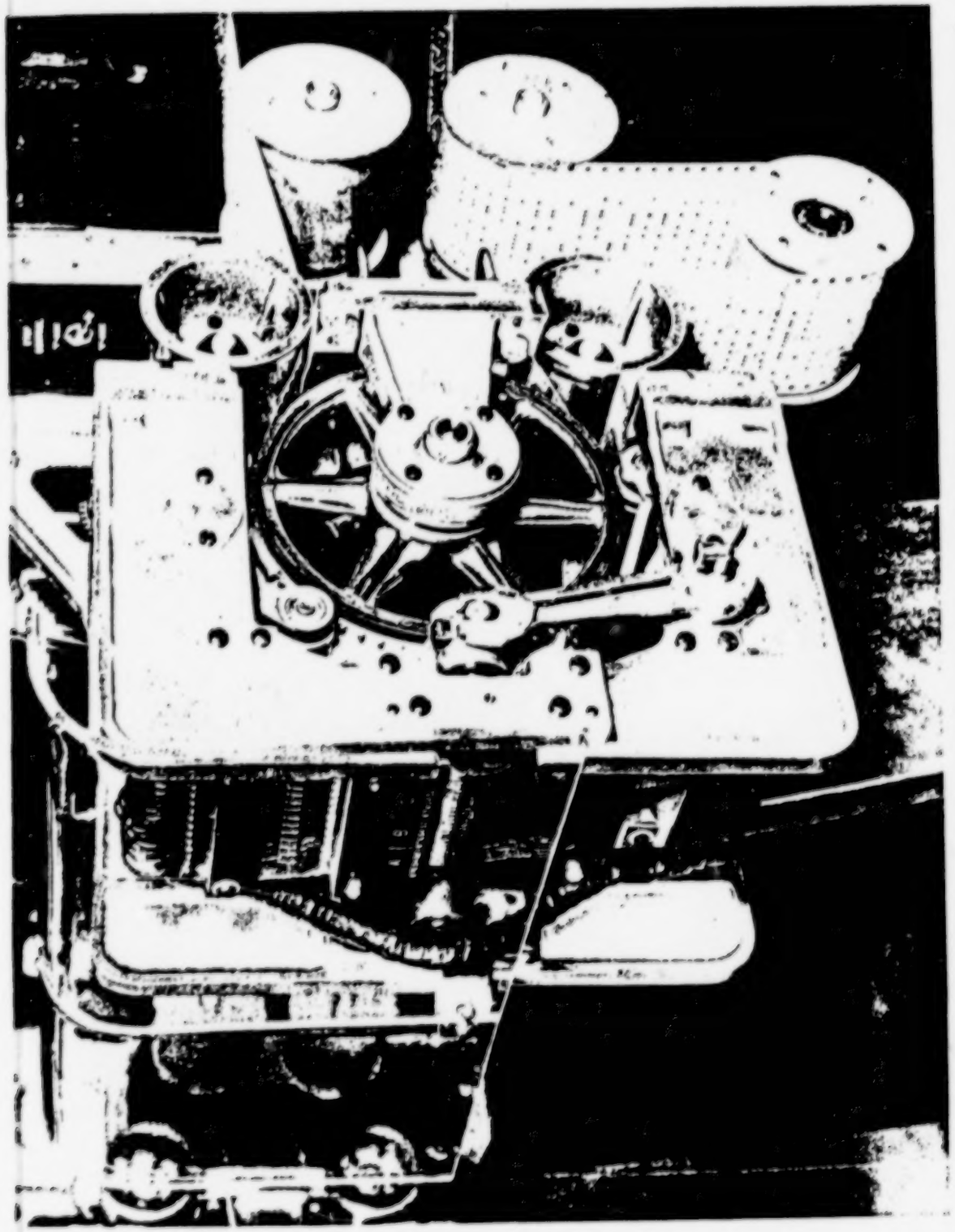


FIGURE 4.

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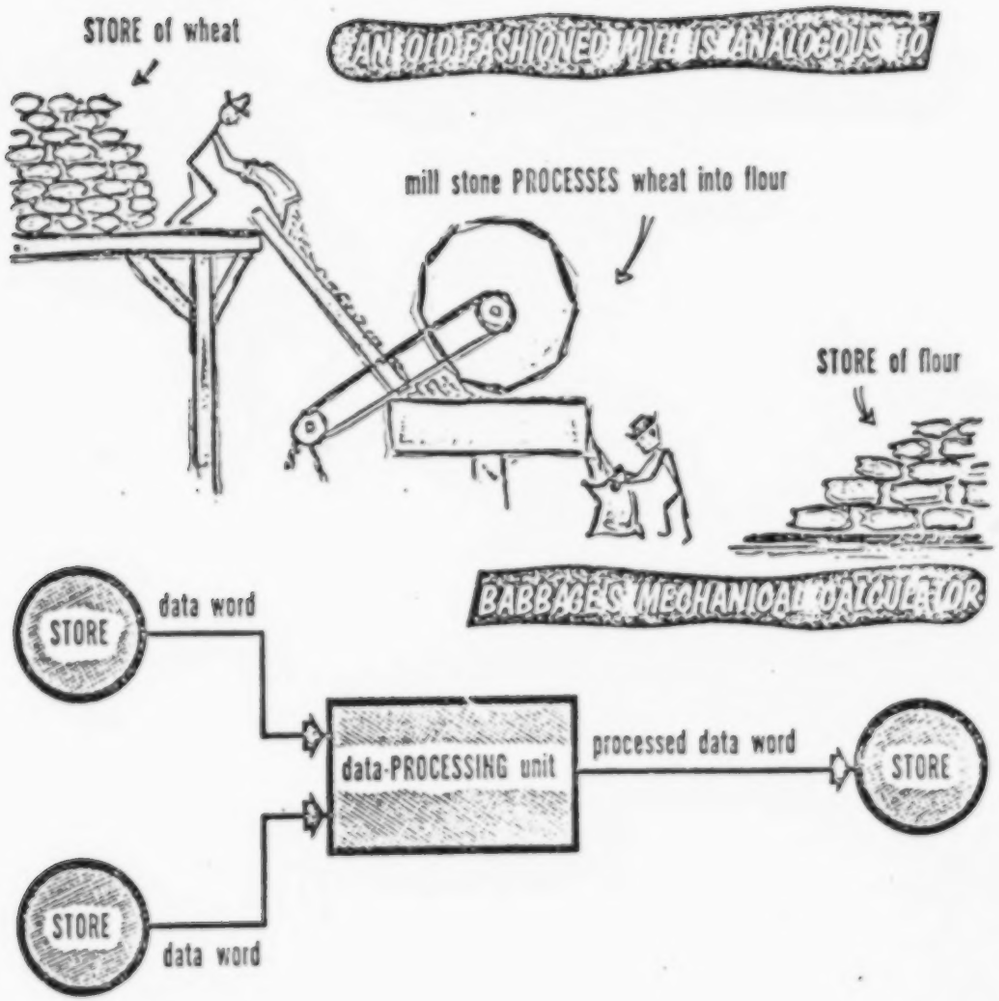

STORE of wheat
AN OLD FASHIONED MILL IS ANALOGOUS TO
mill stone PROCESSES wheat into flour
STORE of flour
BABBAGE'S MECHANICAL CALCULATOR
STORE
data word
data-PROCESSING unit
processed data word
STORE
STORE
data word

FIGURE 5.